

The Marin Countywide Plan

Environmental Quality Element Technical Report #2 Mineral Resource Preservation in Marin County



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ENVIRONMENTAL QUALITY ELEMENT
TECHNICAL REPORT #2
MINERAL RESOURCE PRESERVATION SITES IN MARIN COUNTY

EXECUTIVE SUMMARY

The California Surface Mining and Reclamation Act of 1975 directs local cities and counties to adopt policies in their general plans to preserve and protect certain designated mineral resource sites from premature development or other land use incompatible with the extraction of the identified mineral. The State's purpose is to make sure that necessary mineral and construction commodities are located reasonably close to their markets and that the reclamation of mined lands prevents adverse effects on the environment and public health.

Eight sites in Marin County have been "designated" by the California State Department of Conservation Division of Mines and Geology as having significant mineral resources for the North Bay region. Sites were designated which contained deposits that were 1) suitable as marketable commodities, and 2) meeting a threshold value defined as a gross selling price of at least \$5 million in 1978 dollars.

The North San Francisco Bay Production-Consumption Region includes Sonoma, Marin and Napa Counties. The Region is dependant upon both crushed stone and alluvial deposits for construction, in particular asphaltic concrete, aggregate, road base or subbase materials and Portland Cement Concrete. Total aggregate consumption through the year 2030 is estimated to 478 million tons for the North Bay region based on consumption records and population estimates from the past 28 years.

Ring Mountain is considered to be a Scientific Resource Zone (SZ) rather than a production site due to the rare geologic formations found there. Seven other sites in Marin County have been identified as Mineral Resource Zone Class 2 or MRZ-2. The eight sites include:

1. Ring Mountain, Tiburon.

The 190 acre site is located at the base of the Tiburon Peninsula and would be precluded from further development as a result of these policies. It contains rare, colorful and enigmatic metamorphic rock as well as many species of rare plants.

2. (Sector D-1) Novato Conglomerate - Black Point.

The site is located within the city limits of Novato and contains a thick accumulation of well-rounded pebbles, cobbles and boulders in a well-cemented sandy matrix suitable for Portland Concrete Cement. It is calculated to have 18.47 million tons and is currently owned by Debra Homes Inc., Novato Horsemen, and Bahia Valley Memorial Park. It would be subject to mineral resource policies adopted into the Novato General Plan only.

3. (Sector D-2) Novato Conglomerate - Black Point.

This site is located at the Renaissance Faire/Living History Centre and was once quarried for the conglomerate it contains. It is estimated to have 10.64 million tons. It too is subject to mineral resource policies adopted into the Novato General Plan only.

4. (Sector I) Franciscan Complex Sandstone - San Pedro Hill.

The site is located at the tip of the San Pedro Peninsula just outside San Rafael city limits and has been mined since the turn of the century. PCC aggregate, rip rap and shale have been quarried over the years, supplying materials for bricks, tile and light weight aggregate. A reclamation plan was filed in 1976 and amended in 1982. San Rafael's policies for the reclamation of the site are expressed in the City's Peacock Gap Neighborhood Plan.

5. (Sector J.) Sonoma Volcanics Andesite - Burdell Mountain.

The 50-acre site is located on the east side of Mount Burdell and contains a large block of andesite suitable for asphaltic concrete aggregate or road base material. The presence of sufficient andesite was disputed by the owner, Mt. Burdell Partners, who presented a study by a qualified geologist confirming that most of this material had already been extracted over a 20-year period ending in 1977. After considering this testimony, the Planning Commission has recommended that this site be exempted from the application of Mineral Resource Preservation Policies.

6. (Sector L.) Franciscan Complex - Borello Quarry.

The site is located 3.5 miles north of Point Reyes Station and contains sandstone, shale, greenstone, chert and pillow lavas. Greenstone and pillow lavas are mined and sold for road base material and drain rock.

7. (Sector M.) Franciscan Complex Serpentinite - Ghilotti Quarry. Located on the southwest slope of Burdell Mountain and 3 miles northwest of downtown Novato, this site contains serpentinite, dark green to grayish-green in color, suitable for subbase material after crushing.
8. (Sector V.) Sonoma Volcanics Andesite - Burdell Mountain Open Space Preserve. Adjacent to Sector J., this site also contains hard, dense andesite suitable for asphaltic concrete aggregate. It is owned by the Marin County Open Space District and located within Novato city limits. It is a management policy of the District to prohibit the collection or exploitation of minerals from its lands as these activities are incompatible with the Open Space use of the land.

The policy framework recommended in Technical Report #2 for general plan amendment serves to protect the above listed mineral resource sites from untimely development and incompatible land uses while ensuring that all mining operations provide adequate reclamation plans. Implementation measures would apply a new overlay zone "Designated Mineral Resource" to the identified sites in unincorporated Marin County.

The overlay zone would prohibit any temporary or permanent land uses which would preclude eventual extraction of the mineral resource and would require the creation of buffer land uses between the potential extraction areas and surrounding areas. Notice would be recorded on property titles identifying the presence of important mineral resources. Implementation would also include amendments to Chapter 23.06 of the Marin County Code to require quarry permit applications to report how nuisances, hazards and adverse environmental impacts created by the mining operation would be mitigated including the protection of wetlands and the reduction of negative visual impacts. All new quarry permit applications would be subject to an Initial Study to determine if an Environmental Impact Report should be required.

Once a site is mined and satisfactory evidence is presented to the Planning Department that it no longer contains the threshold amount of mineral resource, the County shall institute action to remove the site from the application of its Mineral Resource Preservation Policies.

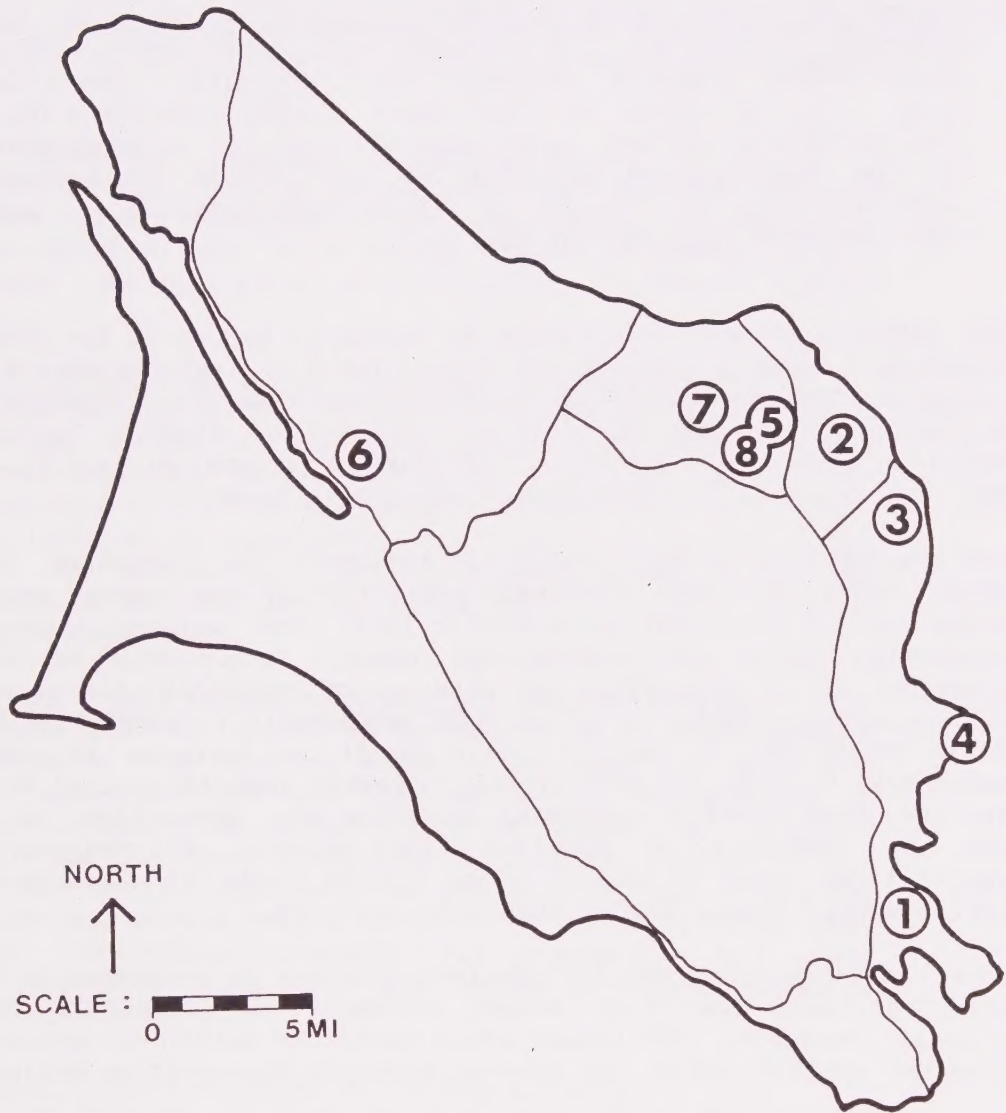


Figure 1. LOCATION OF MINERAL
RESOURCE PRESERVATION SITES

Source: State Mining and Geology Board, Jan. 1987.

I. PURPOSE

The purpose of this Technical Report is to summarize information now available on seven sites in Marin County which have been identified by the California State Department of Conservation Division of Mines and Geology as being significant mineral resources for the North Bay region. The County will establish policies regarding the protection of these sites as well as their future reclamation and reuse for amendment to the Environmental Quality Element of the County's general plan.

The County is undertaking this work in response to State directives under the Surface Mining and Reclamation Act of 1975 (SMARA). The Division of Mines and Geology has developed and applied a broad classification system for all mineral resources in California. This classification system has allowed the State Mining and Geology Board to "designate" certain highly valuable sites for which local general plan resource preservation policies are required. Many currently active or previously active quarry sites in the County are not included in this classification, because they are considered to be of local rather than regional significance. The local general plan policies must be approved by the Mining and Geology Board before they can be effectively implemented under the powers of the Act.

II. NORTH SAN FRANCISCO BAY PRODUCTION-CONSUMPTION REGION

The State has prepared information by region as to the mineral deposits including aggregate of statewide or regional significance. The North San Francisco Bay Production-Consumption Region includes Sonoma, Marin and Napa Counties. The Region is dependant upon both crushed stone and alluvial deposits for construction, in particular asphaltic concrete aggregate, road base or subbase materials and Portland Cement Concrete (PCC). Of these resources, fine sand and gravel suitable for Portland Cement Concrete appears to be the most limited in supply.

Each aggregate resource site has been termed a "Sector" for purposes of volume calculations and to signify that it has not been subject to urbanization. In the North San Francisco Bay Production-Consumption Region, 25 Sectors containing a total of 2.4 billion tons of aggregate resources were identified. Many Sectors contained active quarrying operations.

The total aggregate consumption through the year 2030 is estimated to be 478 million tons for the North Bay region. This projection was derived from consumption records and population estimates from the past 28 years. The average per capita rate per year is 8.8 tons. The per capita rate may be expected to differ if growth patterns in the North Bay change. Unforeseen events, such as disaster reconstruction, could dramatically change the consumption pattern, as well.

Table 1. Summary of Designated Mineral Resource Sites in Marin County

DESIGNATED SECTOR	SUBJECT PARCEL #	TYPE OF RESOURCE	ESTIMATED AMOUNT	OWNER(S)	CURRENT LAND USE	ADJACENT LAND USES	CURRENT ZONING	JURISDICTION
Ring Mountain	38-182-31, 32,36,37	Franciscan Melange, Chlorite Schist, Meta- morphitic Rock, Serpentine	Not Applicable	Nature Conservancy	Nature Preserve	Residential, Open Space	RSP 0.187, Residential Single Family Planned, .187 units per acre	Marin County
D-1	143-151-01, 02,13	Sand, Gravel Rhyolite, Black Chert	18.47 million tons	Debra Homes, Bahia Valley Memorial Park, Novato Horsemen Inc.	Vacant	Residential, Cemetery, Horse Farm	PC-Planned Community, A-2:B-4, CP-Planned Commercial	Novato
D-2	157-470-07, 09	Sandstone, Shale	Not Available	Living History Centre	Outdoor Fairs	Residential, Agriculture	RCR, Rest- ricted Commercial Recreation	Novato
I	184-01-15, 16, 52	Sandstone, Shale	Not Available	Dutra Construc- tion Company	Quarry	Park, Residential, San Francis- co Bay	RMPC, Residential/ Commercial Multiple Planned	Marin County
J	125-180-62	Andesite	7.1 million tons	Mt. Burdell Enterprises, Mt. Burdell Part- ners	Vacant	Open Space, Agriculture	A-60, Agriculture 60 acres per unit	Marin County
L	119-010-08, 119-060-12	Sandstone, Shale, Greenstone, Chert, Pillow Lava	Not Available	Robert & Judy Borello	Quarry	Agriculture, Open Space	C-APZ-60, Coastal, Agriculture Production 60 acres per unit	Marin County
M	125-150-26	Serpentin- ite	Not Available	Crawford A. Cooley Trust et al.	Quarry	Open Space, Agriculture	A-60, Agriculture, 60 acres per unit	Marin County
V	125-180-57	Andesite	31 million tons	Marin County Open Space District	Public Open Space	Vacant, Agriculture	PC, Planned Commercial	Novato

Seven of the sites designated by the State Division of Mines and Geology in Marin County have been identified as Mineral Resource Zones, Class 2 or MRZ-2. MRZ-2 lands contain:

- 1) a deposit composed of material that is suitable as a marketable commodity, and
- 2) the deposit meets a threshold value defined as a gross selling price of at least \$5 million in 1978 dollars.

The eighth site, Ring Mountain, is considered to be a Scientific Resource Zone (SZ) rather than a production site due to the rare geologic formations found there.

III. DESCRIPTION OF IDENTIFIED SITES AND ASSOCIATED RESOURCES

In this report, each of the subject sites will be described in detail. A summary of the following descriptions of the subject sites is shown on Table 1 of this report. Much of the material has been collected from two sources: 1) PART III of Special Report 146 Classification of Aggregate Resource Areas North San Francisco Bay Production - Consumption Region, published by the Division of Mines and Geology, 1983, and 2) the Environmental Impact Report for the State's Designation of Regionally Significant Construction Aggregate Resources (SCH#84121817) July 1985. The Marin County Planning Department is the source for zoning and land use information. The Marin County Assessor is the source for current ownership.

Ring Mountain, Tiburon. The area known as Ring Mountain is located at the north end of the Tiburon Peninsula and is situated between the city boundaries of Tiburon and Corte Madera. The 190 acre site is the highest point on the peninsula and has been designated by the State as a Scientific Resource Zone (SZ) rather than a Mineral Resource Zone (MRZ).

The area was mapped by state geologists Rice and Smith in 1976 and was described by them as "an important and famous geological locality. The rare, colorful, and enigmatic metamorphic rocks that occur there have been studied by geologists and mineralogists for many decades, but their origins are still not fully understood. This area should be preserved in its present condition for further study and as a natural geologic exhibit." In addition to geologic factors of interest, the site also contains many species of rare plants, and due to its elevation is highly visible to the surrounding communities. (See Map 1)

The opportunity to preserve the site came in 1985 when the private owners of the majority of Ring Mountain (a 435 acre site) sought approval of a master plan to develop residential units on the lower portions of the mountain. Through the Master Plan process, the resource site, over

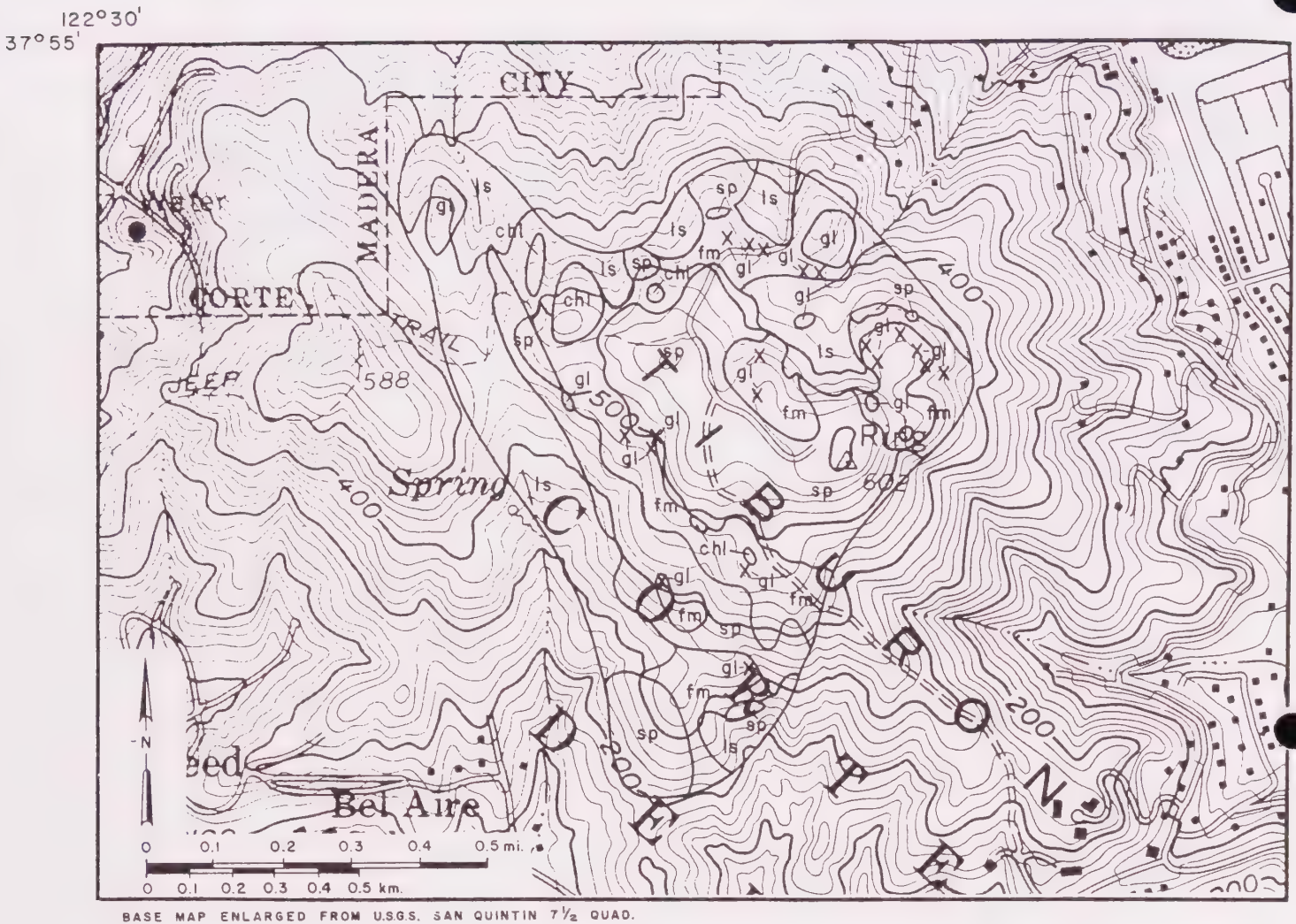


Figure 3.2 Geologic map of the Ring Mountain Scientific Resource Zone. Geology and explanation from Rice and Smith, 1976, Plate 1E.

EXPLANATION

fm = Franciscan Melange. A tectonic mixture consisting of small to large masses of resistant rock types, principally of sandstone, greenstone, chert, and serpentine, but including various exotic metamorphic rock types embedded in a matrix of pervasively sheared or pulverized rock material. Masses too small to delineate at map scale are indicated by the symbol "x".

chl= Chlorite schist. A dull green schistose rock composed principally of chlorite, commonly containing veins of tremolite.
gl = Metamorphic rock. Chiefly dense, coarsely crystalline, dark-bluish glaucophane-bearing schists or gneisses and dark-green eclogite.
sp = Serpentine. Pale green to dark-green, fine-grained metamorphic rocks composed almost entirely of the magnesium silicate minerals lizardite and chrysotile.
ls = Landslide

300 acres, was offered and purchased by the Nature Conservancy, a private non-profit organization, for preservation as a permanent environmental exhibit. The Nature Conservancy owns lands beyond the designated resource site and as active conservators, provides nature orientation tours of the property. County zoning for the site is now RSP 0.187, Residential, One-Family Planned District with a density of one dwelling unit per 5.34 acres.

Assessor Parcel Numbers of Subject Parcels: 38-182-31,32,36,37
Current Owner: Nature Conservancy, c/o Will Murray, 785 Market St., San Francisco, CA 94103

Sectors D-1 and D-2. Novato Conglomerate - Black Point. (Map 2. Petaluma River Quadrangle and Map 3. Novato Quadrangle.) This sector appears in two parts D-1 and D-2. Both are located within Novato City limits, and would not be subject to County general plan policies, but rather to Novato general plan policies. However, it has been County policy to list data for properties within city boundaries in technical reports for purposes of public service and coordination.

The sites are portions of a prominent ridge that is underlain by Novato Conglomerate, a thick accumulation of well-rounded pebbles, cobbles and boulders in a well-cemented sandy matrix. Most of the coarse material is rhyolite or black chert. The sand and gravel is suitable for Portland Concrete Cement which was at one time produced at a quarry located at Sector D-2. Although the entire ridge between D-1 and D-2 (along Atherton Avenue) appears to contain the deposit, the majority of the ridge has been developed for homesites.

Sector D-1 is calculated to have 18.47 million tons, and Sector D-2 is calculated to contain 10.64 million tons for a total of 29 million tons of PCC grade aggregate. The two Sectors together total 325 acres.

Sector D-1 is currently owned in part by Debra Homes Inc., Bahia Valley Memorial Park, and Novato Horsemen Inc. The zoning under City of Novato jurisdiction is PC, (Planned Community), CP, (Planned Commercial) and A-2:B-4, (Single Family Residential.) Although existing land use is vacant, adjacent uses include low density residential development, cemetery and horse farm.

Assessor Parcel Numbers of Subject Parcels: 143-151-01,02,13
Current Owners: Debra Homes Inc., P.O. Box 6855, Santa Rosa, CA 95402
Bahia Valley Memorial Park, 650 Bugeia Ln, Novato, CA 94947
Novato Horsemen, Inc. 600 Bugeia Lane, Novato, CA 94947

Sector D-2 is zoned PCR, (Planned Commercial Recreation). It is owned by the Living History Centre. During the summer months, the majority of the site is converted for outdoor entertainment fairs, and is best known

Map 2. Petaluma River Quadrangle



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PETALUMA RIVER QUADRANGLE
SMARA DESIGNATION MAP NO. 85-5
NORTH SAN FRANCISCO BAY PLATE II



TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
Reduced from 1:24,000



CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 10 FOOT CONTOURS
NATIONAL GEODESIC VERTICAL DATUM OF 1929
DEPTH CURVES IN FEET; DATUM IS MEAN, LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS UNKNOWN
SHORELINE REPRESENTS THE APPROXIMATE HIGHEST OF HIGH WATER
THE HIGHEST OF HIGH WATER IS APPROXIMATELY 5 FEET

Map 3. Novato Quadrangle



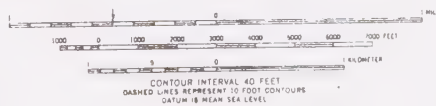
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NOVATO QUADRANGLE
SMARA DESIGNATION MAP NO. 85-5
NORTH SAN FRANCISCO BAY PLATE 10



TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
Reduced from 1:24,000



for the Blackpoint Renaissance Pleasure Faire. An inactive quarry is located along the east slope of the site and is not visible to fair visitors. Adjacent land uses are residential and agricultural.

Assessor Parcel Numbers of Subject Parcels: 157-470-07,09

Current Owner: Living History Centre, 25 Anton Way, Novato, CA 94947

Sector I. Franciscan Complex Sandstone - San Pedro Hill. (Map 4. San Quentin Quadrangle.) The resource material at this site is a hard, slightly metamorphosed sandstone of the Franciscan Complex, with interbedded black shale. The Division of Mines and Geology says that crushed stone suitable for PCC aggregate and rip rap has been quarried from San Pedro Hill since the turn of the century. The shale deposits located along the northern boundary of the site have been developed by several quarries over the years, supplying material for bricks, tile and lightweight aggregate.

The site is located at the tip of the San Pedro Peninsula just outside of San Rafael city limits and County zoning is RMPC Residential/Commercial Multiple Planned District. The January 1988 Draft General Plan for San Rafael identifies preservation of this resource, for the duration of the planning period. The City's Peacock Gap Neighborhood Plan, adopted in 1980 recognizes future conversion of the site to residential, marina and commercial uses; this plan was also adopted by the County.

Because of its location, material from the deposit can be loaded directly onto barges for delivery by waterway. The site is directly adjacent to one of the few deep water areas of San Francisco Bay which touch upon Marin County land masses. For this reason, the site has often been considered for a future port or ferry landing for commuter passenger service. The adjacent land uses are low density residential and park and open space.

In 1976, the owners of the quarry filed a Reclamation Plan in conformance with the Surface Mining and Reclamation Act of 1975. This plan called for a 17-year period (ending in 1993) wherein quarrying operations would continue. Afterwards, the Plan calls for multiple reuse of the entire site for residential/commercial and marina uses. Portions of the site would also be preserved for open space, and marsh reclamation (see Figure 1.) The main quarry bowl would be flooded with bay water to accommodate a protected marina and water-oriented recreation. Revegetation on various portions of the site would be accomplished by hydromulching and planting of local plant materials.

The amount of resource available at the site was not reported by Mines and Geology as it is an active quarry, under private ownership, and this information was considered to be proprietary. The current owners are

Map 4. San Quentin Quadrangle



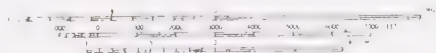
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SAN QUENTIN QUADRANGLE
SHARPS DESIGNATION MAP NO 85-5
NORTH SAN FRANCISCO BAY PLATE 17



TOPOGRAPHIC BASE MAP BY U.S. GEOLOGICAL SURVEY
Reduced from 1:24,000



the Dutra Construction Company and there are no major factors limiting completion of the existing mining operation in this sector.

The County-approved Reclamation and Closure Plan for the site sets forth the procedures required once the mining is complete and/or the owners seek reuse of the site for other purposes. The Plan was amended in 1982 to allow further excavation of blue sandstone recently located on the site by consulting geologists.

Assessor Parcel Numbers of Subject Sites: 184-01-15,16,52
Current Owner: Dutra Construction Co. Inc., Vern S. Bothwell Esq.,
Feldman, Waldman & Kline, 235 Montgomery St. Ste. 270,
San Francisco, CA 94104

Sector J. Sonoma Volcanics Andesite - Burdell Mountain. Map 2. Petaluma River Quadrangle. The site is located on the east side of Mount Burdell. The site is underlain by a large block of andesite estimated to be 200 feet thick. This material is found within landslide debris that has moved downhill from the lava-capped crest. The andesite is suitable for asphaltic concrete aggregate or road base material.

A processing plant was set up at this site in 1954 for the production of crushed stone, but is no longer active. An estimated 7.1 million tons have been mined from the site, leaving 8 million tons of mixed non-PCC grade resource available.

The owners of this site produced a study prepared by a qualified Engineering Geologist in February 1988 which disputed the State's estimate of rock reserves left at the site. (See Appendix 2. E.C. Winterhalder Letter) The State's estimate of reserve appeared to be based on measurements taken in 1955, shortly after the quarry was opened. The owner's geologist maintains that a maximum of .4 million tons of reserve actually remains that meet State specifications for asphalt concrete aggregate or roadbase material. Even if the entire recoverable volume of volcanic rock were suitable, it would only have a value of \$3.6 million (at \$2 per ton) which is far below the threshold value for a significant resource. Considering these facts, the County Planning Commission has recommended that this site be exempt from application of these policies.

The 50-acre resource site is contained within lands owned jointly by the Mt. Burdell Enterprises and Mt. Burdell Partners LTD. The County zoning is A-60, Agriculture, 60 acres per residential unit. It is located directly adjacent to Sector V which is owned by the Marin County Open Space District and to undeveloped State-owned lands intended for future park (Olompali Park). The steep terrain of the site is accessed by a paved private road on the east side. The site is visible from Highway 101. Current land use is vacant; adjacent land uses are public open space, and agriculture.

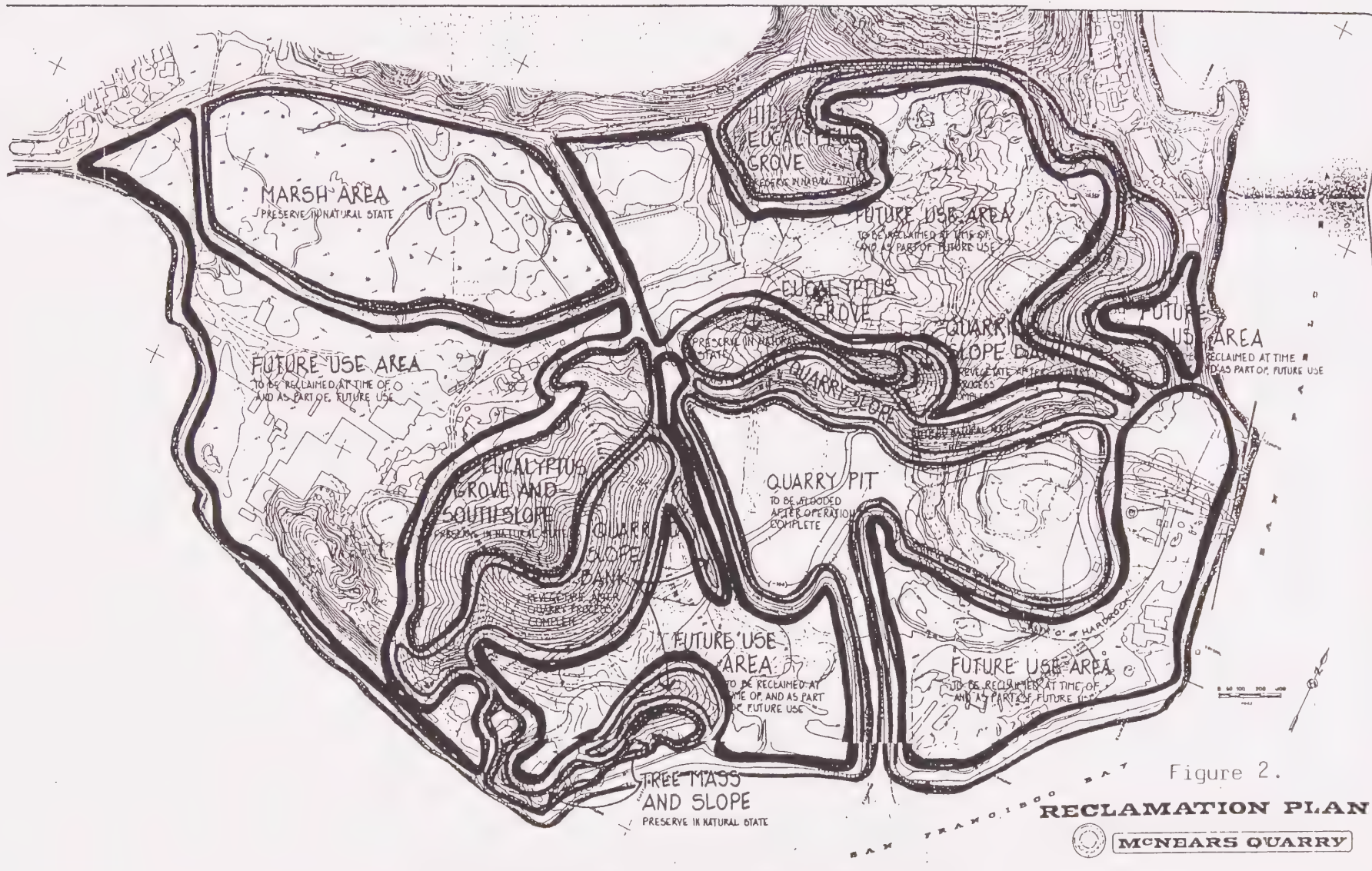


Figure 2.

RECLAMATION PLAN

MCNEARS QUARRY

Assessor Parcel Numbers of Subject Parcels: 125-180-62
Current Owner: Mt. Burdell Enterprises, Mt. Burdell Partners LTD.,
7 Fairway Dr., Mill Valley, CA 94941

Sector L. Franciscan Complex - Borello Quarry. Map 5. Inverness Quadrangle. This site is located 3.5 miles north of Point Reyes Station and 1.1 miles east of Tomales Bay in an area called Millerton Gulch. It contains sandstone, shale, greenstone, chert, and pillow lavas of the Franciscan Complex. A quarry has been in operation since the late 1950's where the greenstone and pillow lavas are mined and sold for road base material and drain rock. Reserve estimates for the Quarry are proprietary and not available.

The 15-acre resource site is contained within lands owned by R.A. and Judy Borello. Adjacent land uses are agricultural and open space. The County zoning is C-APZ-60, (Coastal Agricultural Production Zone, one dwelling unit per 60 acres.) A use permit for the quarry was obtained in October 1970. Besides being located in the Coastal Zone, the site is also located in the Alquist-Priolo Special Studies Zone where any development would be subject to earthquake protection requirements.

Assessor Parcel Numbers of Subject Parcels: 119-010-08 & 119-060-12
Current Owner: Robert A. & Judy Borello, P.O. Box 350, Pt. Reyes Station, CA 94956

Sector M. Franciscan Complex Serpentinite - Ghilotti Quarry. Map 2. Petaluma River Quadrangle. Sector M is located at the end of Bowman Canyon on the southwest slope of Burdell Mountain in Novato. The quarry contains serpentinite of the Franciscan Complex which is highly fractured and sheared, dark green to grayish-green in color; this material is suitable for subbase material after crushing.

The 40-acre resource site is currently being quarried by Ghilotti Brothers, Inc. and has been open since 1965. The total resource present is considered proprietary information and is not available.

Adjacent land uses are open space and livestock grazing. This site is accessed via Hicks Valley Road 3 miles northwest of downtown Novato. County zoning of the site is A-60 and the current owner is Cooley A. Crawford Trust et al.

Assessor Parcel Numbers of Subject Site: 125-150-26
Current Owner: Crawford A. Cooley Trust et al., 2600 Novato Blvd.,
Novato, CA 94947

Sector V. Sonoma Volcanics Andesite - Burdell Mountain Open Space Preserve. (Map 2. Petaluma River Quadrangle.) Adjacent to Sector J., Sector V is underlain by a large block of hard, dense andesite suitable for asphaltic concrete aggregate. Although the resource has never

Map 5. Inverness Quadrangle



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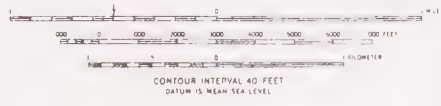
INVERNESS QUADRANGLE

SMARA DESIGNATION MAP NO 85-5
NORTH SAN FRANCISCO BAY PLATE 19

SECTOR L



TOPOGRAPHIC BASE FROM U.S. GEOLOGICAL SURVEY
Reduced from 1:24,000



been mined, the Division estimates that this sector contains 31 million tons of aggregate.

Sector V covers approximately 80 acres and is located within lands owned and operated by the County of Marin Open Space District. The site is open for public use for hiking, camping, and horsebackriding; the District also leases the property for grazing by dairy cows to control wildfire. It is a management policy of the District to prohibit collection or extraction of minerals from its lands as these activities interfere with Open Space uses. Adjacent land uses include the abandoned quarry on Sector J and other rural residential development. The land is zoned PC, Planned Community under City of Novato jurisdiction.

Assessor Parcel Number of Subject Site: 125-180-57

Current Owner: Marin County Open Space District, c/o Fran Brigmann,
Civic Center, San Rafael, CA 94903

IV. MARINE SAND AND GRAVEL DEPOSITS WITHIN COUNTY BOUNDARIES

Offshore sand and gravel dredging has been another source of aggregate, but offshore sites have not been designated by the Division of Mines and Geology. Three sites with material accessible enough and valuable enough for dredging have been identified (see Map 6. Marine Sand and Gravel Deposits):

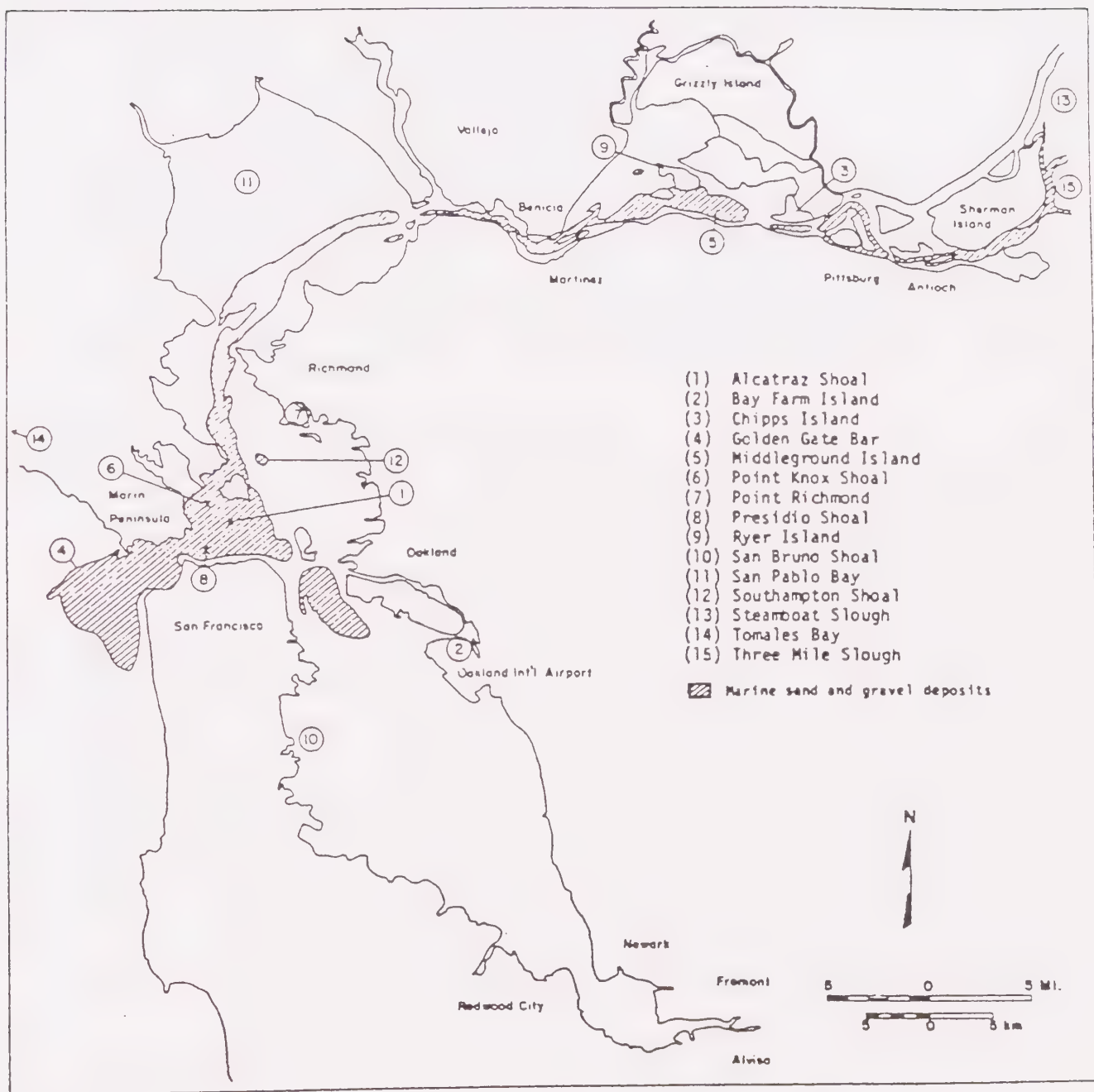
- 1) Point Knox Shoal - southwest of Angel Island, currently being dredged, and under lease from State Lands Commission, 37.5 million tons,
- 2) Golden Gate Bar - southwest of Marin Headlands, outside of the Golden Gate, no estimate made of volume material available,
- 3) Tomales Bay - 52.5 million tons.

V. RECOMMENDED POLICY FRAMEWORK FOR GENERAL PLAN AMENDMENT

The Marin Countywide Plan is the legal vehicle to establish ways to protect and assure the wise use of identified mineral resources through local land use policies in unincorporated Marin County; similar general plans exist for each of the eleven cities and towns in the county. The State's Surface Mining and Reclamation Act of 1975 requires that local jurisdictions adopt mineral resource management policies and implementation measures within 12 months of official receipt of the State's designations. Marin County received its official designations in April 27, 1987, and must adopt policies by April 27, 1988.

The general plan policies must be approved by the State Division of

Map 6. Marine Sand and Gravel Deposits.



Marine sand and gravel deposits in San Francisco Bay and Sacramento River - Delta (after E.E. Weldon, 1975). Known aggregate deposits are shown by hachures.

Mines and Geology Board which has established the following Interim Criteria for Mineral Resources Management Policies:

Data and Analysis

The Surface Mining and Reclamation Act (SMARA) requires all affected cities and counties to incorporate into their general plans the mineral classification and designation information prepared by the State Geologist and approved and transmitted by the Board. Lead agencies shall incorporate into their general plan:

- 1) a summary of the information provided by the classification and designation reports or incorporate SMARA and Board policy by reference, and
- 2) maps of mineral resource areas (or incorporate by reference the classification and designation maps provided by the Board.)

Policy Statements

Lead agencies shall adopt statements of policy recognizing the importance of the identified mineral resources, clarifying the intent that this information is to be used when making land use decisions in areas designated to be of statewide or regional significance, and emphasizing the conservation and development of identified mineral deposits.

Implementation Measures

In addition to a summary of the data and the adoption of policies to protect the identified mineral resources, lead agencies shall develop implementation procedures. These shall include at least two of the following:

- * Reference in general plan to location of identified mineral deposits, and a discussion of those areas targeted for conservation and possible future extraction by the lead agency.
- * Use of overlay maps or inclusion of information on any appropriate planning maps to clearly identify mineral resource areas, and those areas targeted by the lead agency for conservation and possible future extraction.
- * Use of special purpose overlay zones, mineral resource /open space zoning, or any other appropriate zoning that would:
 - 1) identify the presence of important mineral resources,

and

2) restrict the encroachment of incompatible land uses, in those areas that are to be conserved.

- * Record on property titles in the affected mineral resource areas a notice identifying the presence of important mineral resources.
- * Impose conditions upon incompatible land uses in and surrounding mineral resource zones for the purpose of mitigating the significant land use conflicts prior to approving a use that would otherwise be incompatible with mineral extraction.

VI. DRAFT GENERAL PLAN POLICIES AND IMPLEMENTATION MEASURES

The policies and implementation measures which follow are proposed for amendment to the Marin Countywide Plan, the County's general plan. These policies and implementation measures would have effect in the unincorporated portions of the county only. However, since the State requires cities and towns to adopt similar regulations for designated sites located within city limits, these policies are advisory to the City of Novato and may be adopted by the City as well.

Each policy in the Countywide Plan is labelled with the abbreviation of the element in which it appears and the number of that policy within the element. An example is policy EQ-84, which is the 84th policy in the Environmental Quality element. Each implementation measure relates to a specific policy, but is further identified by the initial "I" for implementation measure, and lower case a,b,c, etc. to indicate different implementation measures for the same policy. An example is implementation EQ-84-Ia., which means the first Implementation for policy EQ-84.

The following policies and implementation measures would be amended to the existing Environmental Quality Element:

EQ-84. The County shall protect designated sites from temporary or permanent land uses which would preclude or inhibit timely mineral extraction to meet market demand.

EQ-84-Ia. The County shall assign the label "Designated Mineral Resource" and shall create and map an overlay zoning district for all Sectors designated by the California Division of Mines and Geology within unincorporated Marin County. These sites include all or portions of the following parcels, identified by Assessor Parcel Numbers:

184-01-15,16,52 (San Pedro Hill), 119-010-08 and 119-060-12 (Borello), 125-150-26 (Ghilotti). Further reference may be found in Part III. Classification of Aggregate Resource Areas North San Francisco Bay Production-Consumption Region. Special Report 146 by the California Department of Conservation, Division of Mines and Geology, 1983.

- EQ-84-Ib. The County shall further assign the label "Designated Mineral Resource-Scientific Zone" to all or portions of the following parcels (Ring Mountain) 38-182-31,32,36,37 to preclude future development or mining operations on this unique resource and will indicate affected areas on county zoning maps.
- EQ-84-Ib. The County shall record on property titles in the affected mineral resource areas a notice identifying the presence of important mineral resources.
- EQ-85. The County shall further protect designated mineral resource sites by creating a buffer of land uses between potential mineral extraction areas and areas with land uses incompatible with mining.
- EQ-85-Ia. The County shall include requirements in its "Designated Mineral Resource" overlay zone district to require a sufficient buffer of land uses between mining and land uses incompatible with mining.
- EQ-86. The County shall ensure that after mitigation measures are taken, a proposed mining operation will not create significant nuisances, hazards or adverse environmental impacts.
- EQ-86-Ia. The County shall amend Marin County Code Section 23.06.040 Application (for mining permit) to require applicants to list what mitigations will be taken to address nuisances to neighboring properties, hazards or adverse environmental impacts created by the proposed mining operation.
- EQ-86-Ib. The County shall require an Initial Study and may require an Environmental Impact Report on all mining or quarrying permits requested after the date of adoption of these policies.
- EQ-87. The County shall ensure that all mining operations provide for adequate reclamation of mined lands before issuing mining or quarrying permits including protection of wetlands and reduction of negative visual impacts.
- EQ-87-Ia. The County shall continue to enforce the reclamation

requirements of Marin County Code Section 23.06.

- EQ-87-Ib. The County shall augment Section 23.06.40(5) Application to require Reclamation plans to include a) protection of wetlands, if any and b) reduction of negative visual impacts.
- EQ-88. Wetlands proposed for excavation shall be reviewed for significant habitat value and will be protected in lieu of mining where significant mineral resources have been identified.
- EQ-89. Wetlands that are mined shall be reclaimed and returned to wetland status after conclusion of mining operations.
- EQ-90. When a site is mined and satisfactory evidence is presented that it no longer contains the threshold amount of resource, the County shall institute action to remove the site from the application of these mineral resource preservation policies.

VII. PROPOSED IMPLEMENTATION PROGRAM

In summary, the implementation measures require:

- 1) The creation and application of a new overlay zone, "Designated Mineral Resource" to sites designated by the State confirmed by the County as being significant including the application of the overlay zone with special provisions to portions of Ring Mountain as a "Designated Mineral Resource-Scientific Zone";
- 2) The mapping of the overlay zone onto County zoning maps identifying parcels or portions of parcels that contain mineral resources of statewide or regional significance as identified in this report, except for Sector J.
- 3) This zone would require that no temporary or permanent land uses occur on designated sites which would preclude eventual extraction of the mineral resource contained therein. In the case of Ring Mountain, a Designated Mineral Resource-Scientific Zone, further protections would preclude any development of the site.
- 4) The zone would require creation of buffer land uses between the potential extraction areas and surrounding areas.
- 5) Implementation would also include certain amendments to Chapter 23.06 Regulation and Control of Surface Mining and Quarrying Operations including:

- a) additional application materials for a mining or quarrying permit requiring information on how nuisances to neighboring properties, hazards and adverse environmental impacts created by the proposed operation would be mitigated including protection of wetlands and reduction of negative visual impacts; and
- b) required preparation of an Initial Study to determine if an Environmental Impact Report is needed for any new mining or quarrying permit.

Chapter 23.06

REGULATION AND CONTROL OF SURFACE MINING
AND QUARRYING OPERATIONS*

Sections:

23.06.010	Purpose.
23.06.020	Definitions.
23.06.025	Coastal zone.
23.06.030	Permit.
23.06.040	Application.
23.06.050	Land reclamation requirements.
23.06.060	Fees.
23.06.070	Revocation.
23.06.080	Security deposits.
23.06.090	Inspections.
23.06.100	Existing operations.
23.06.110	Appeal.
23.06.120	Violations.

23.06.010 **Purpose.** The provisions of this chapter are intended to regulate and control surface mining and quarrying operations for the purposes enumerated in Chapter 23.02 of this title. In addition, the provisions of this chapter are intended to insure that all areas of lands affected by such operations shall be reclaimed, i.e., rehabilitated or restored to as nearly a natural appearance as possible, to be compatible with surrounding properties or for other contemporary uses. (Ord. 1844 § 2 (part), 1971).

23.06.020 **Definitions.** As used herein, the following words shall have the designated meanings:

(1) "Area of land affected" means the area of land from which overburden is to be or has been removed and upon which the overburden is to be or has been deposited and includes all lands affected by any phase of exploration, mining, quarrying, processing and waste and tailings disposal, and includes access roads and pond sites;

(2) "Operation" means all of the premises, facilities, roads and equipment used in the process of producing the mining or quarrying products, from the designated strip mine or quarry area or removing overburden for the purpose of determining the location, quality or quantity of a natural deposit;

(3) "Operator" means any person, partnership, corporation or public agency engaged in or who intends to engage in surface mining or quarrying, or who removes overburden for the purpose of determining the location, quality or quantity of a natural deposit;

(4) "Overburden" means all the earth and other materials, consolidated or unconsolidated, which lie above a natural deposit of mineral or useful rock, and also means such earth and other material after removal from their natural state in the process of surface mining;

(5) "Person" means persons, partnership, corporation or public agency;

(6) "Quarrying" means the surface exploitation of rock or mineral deposits from the earth's crust;

(7) "Reclamation" means the combined process of land treatment that minimizes water degradation, air pollution, damage to aquatic or wildlife habitat, flooding, erosion, and other adverse effects, from surface mining operations including adverse surface effects incidental to underground mines, so that mined lands are reclaimed to a usable condition which is readily adaptable for alternate land uses and create no danger to public health or safety. The process may extend to affected lands surrounding mined lands and may require backfilling, grading, resoiling, revegetation, soil compaction, stabilization, or other measures;

(8) "Stream" means a natural watercourse designated as a perennial or intermittent stream on the most recently published United States Geological Survey 7.5 Minute Series Topographic Map, or a natural watercourse which, at the time of the surface mining or quarrying operation within the drainage basin, is flowing water;

(9) "Surface mining" means all, or any part of, the process involved in the mining of minerals on mined lands by removing overburden and mining directly from the mineral deposits, open-pit mining of minerals naturally exposed, mining by the auger method, dredging and quarrying, or surface work incident to an underground mine. Surface mining operations shall include but are not limited to:

- (a) in place distillation or retorting or leaching;
- (b) the production and disposal of mining waste;
- (c) prospecting and exploratory activities. (Ord. 2222 § 1, 1976: Ord. 1844 § 2 (part), 1971).

23.06.025 Coastal zone. Any commercial surface mining or quarrying operation or exploration for such operation within the coastal zone, as defined by the Coastal Act of 1976, may be subject to a coastal development permit pursuant to Chapters 22.56 and 22.57 of this code. Different standards, as set forth in Chapters 22.56 and 22.57, are applicable to projects located in coastal districts. (Ord. 2637 § 9, 1981).

23.06.030 Permit. No person shall engage in any commercial surface mining or quarrying operation, or any exploration for such operation if such exploration exceeds ten thousand square feet of disturbed ground surface or requires the removal of more than one thousand cubic yards of earth, without first securing a permit from the county planning commission. All such permits shall be issued only after a public hearing before the commission. The commission shall approve, conditionally approve, or deny the application not later than the third regular meeting after the filing date of the application, unless a later date is agreed upon by the applicant. Prior notice of the hearing shall be sent to property owners within two thousand five hundred feet of the perimeter of the area of land affected.

The planning commission, or on appeal to it, the board of supervisors shall have the authority to provide for any reasonable special conditions to a permit that it may deem necessary to carry out the purposes of this chapter, or the purposes established by the Surface Mining and Reclamation Act of 1975 (Public Resources Code § 2710, et seq.) and applicable policy rules and regulations of the State Mining and Geology Board adopted pursuant to Public Resources Code § 2755. (Ord. 2222 § 2, 1976: Ord. 1844 § 2 (part), 1971).

23.06.040 Application. All applications required herein shall be filed jointly by the property owner and the mining or quarrying operator and shall contain the following information:

(3) Within ninety days of termination of the actual rock or mineral production, all structures, metal, lumber or other debris resulting from the operation, are to be removed or buried. Such burial is subject to the approval of the director of public works. If specified in the reclamation plan, a structure or materials may be retained on the site for the stated land use objective anticipated after completion of the operation, subject to the approval of the director of public works.

(4) Earth dams may be constructed wherever the formation of lakes for water impoundment does not interfere with the operations or damage adjoining property and is in conformance with the land use objectives in the reclamation plan.

(5) Grading shall be carried out so as to cover, with at least two feet of overburden or other relatively inert natural rock materials, any acid forming or other toxic materials which are exposed by the operations.

(6) All other parts of the reclamation plan are to be completed concurrently with the grading or as soon as practicable after completion of the grading specified in the plan. (Ord. 1844 § 2 (part), 1971).

23.06.060 Fees. The director of public works shall collect fees for processing applications and inspecting work performed pursuant to this chapter. Such fees shall be as established in the current "Resolution of the Marin County Board of Supervisors Establishing Fees for Permits Administered by the Department of Public Works," to cover the cost of processing the application, and an inspection fee determined by the director of public works to cover the cost of inspection. (Ord. 2775 § 1, 1983; Ord. 1844 § 2 (part), 1971).

23.06.070 Revocation. In the event any permittee holding a permit hereunder fails, neglects or refuses to fulfill any of the requirements of this chapter or any of the conditions of the permit or violates any provisions of this title or any other applicable law or ordinance, or conducts or carries on the operation in such a manner as to materially affect adversely the health, welfare or safety of persons residing or working in the neighborhood of the property wherein the operation is being conducted, or conducts or carries on the operation so that it is materially detrimental to the public welfare or injurious to property or improvements in the neighborhood, the planning commission may revoke or suspend the permit.

No permit shall be revoked or suspended until a hearing is held by the planning commission. Written notice of such hearing shall be served upon the permittee and shall state:

(1) The ground for complaint or reasons for the proposed revocation or suspension, in clear and concise language;

(2) The time and place where such hearing is to be held. Such notice shall be served on the permittee at least ten days prior to the date set for the hearing. At any such hearing the permittee shall be given an opportunity to be heard and defend himself and he may call witnesses and present evidence in his behalf. Upon conclusion of such hearing, the planning commission may suspend or revoke the permit upon such terms and conditions as, in the judgment of the commission, will be proper. (Ord. 1844 § 2 (part), 1971).

23.06.080 Security deposits. The planning commission may require such performance bonds or cash as it deems necessary to insure compliance with the regulations herein and any conditions imposed in the quarry or surface mining permit. (Ord. 1844 § 2 (part), 1971).

(1) A precise description of the operating area with an accurate topographic map indicating:

(a) A description of the area of land affected including size, legal description and assessor's parcel number.

(b) A description of the general geology of the area and a detailed description of the geology of the area of operation,

(c) A location of initial excavations and/or explorations.

(d) The approximate area, volume and depth to be excavated.

(e) The location of existing and proposed improvements within the entire area including, but not limited to, all buildings, access roads, processing plants, power and telephone lines and water retaining and storing areas,

(f) The location of stream courses identified and classified as perennial or intermittent.

(g) Photographs showing adequate detail of the general area of operations;

(2) A description of the materials sought, including an estimate of the total volume of such materials and the basis of the estimate;

(3) The anticipated time schedule for mining and quarrying activities, including the number of years of such proposed activities and an indication on the topographic map showing which areas will be mined or quarried during the first three years;

(4) An erosion control plan in accordance with Chapter 24.04, Article VIII, Grading;

(5) A reclamation plan for the entire area of operations, which plan shall include the following:

(a) A statement of the land-use objective anticipated after completion of the operation,

(b) A description of the manner in which contaminants will be controlled and mining wastes will be disposed,

(c) A description of the manner in which rehabilitation of affected streambed channels and streambanks to a condition minimizing erosion and sedimentation will occur,

(d) Methods to implement reclamation pursuant to the requirements of Section 23.06.050,

(e) A revegetation plan for planting or seeding the area of land affected, specifying type, size and provisions for maintenance until the vegetation cover becomes self-sufficient, with emphasis to be placed on native plants,

(f) A time schedule for such reclamation,

(g) An assessment of the effect of implementation of the reclamation plan on future mining in the area;

(6) Such other reasonable and pertinent information as may be required by the planning commission. (Ord. 2802 § 5, 1983; Ord. 2222 § 3, 1976; Ord. 1844 § 2 (part), 1971).

23.06.050 Land reclamation requirements. Unless otherwise specified in the use permit, reclamation shall be done in the following manner:

(1) Grading required under the approved reclamation plan shall be carried out as soon as practicable.

(2) Grading shall be carried out to provide a surface as nearly natural appearing as possible, or to provide a surface consistent with the land use objectives stated in the approved reclamation plan. In all cases, grading shall be done in such a manner as to minimize erosion.

23.06.090 Inspections. The department of public works shall make sufficient inspections of the mining or quarrying operations to insure compliance with the provisions of this chapter and any permits issued hereunder. Upon notification by the operator that operations have been completed in any area, the department shall continue to make inspections to insure that there is compliance with the reclamation and revegetation plans. (Ord. 1844 § 2 (part), 1971).

23.06.100 Existing operations. A lawful surface mining or quarrying operation existing at the time of the adoption of this chapter is not subject to the provisions of this chapter; provided, however, that the owner and operator shall submit a map to the planning commission showing the area of land affected as of the effective date of the ordinance codified herein. Such map must be submitted to the planning commission for approval within six months of the effective date of the ordinance codified herein. The commission shall consider whether the area of land affected as shown on the map is reasonable. If it is found that it is reasonable, then the commission shall approve the map; if not, the commission shall disapprove the map. The commission shall make its finding not later than the third regular meeting after submission of the map.

No such operation may enlarge the area of land affected beyond that identified on the map or maps as approved by the commission. Should any such operation cease for a period of two years or more hereafter, any subsequent operation shall be in conformity with the regulations specified herein.

The benefits of this section shall not be lost or diminished in any way, by a sale, transfer, assignment, lease or other change in the ownership or of the operator of the mining or quarrying operation. (Ord. 1844 § 2 (part), 1971).

23.06.110 Appeal. The applicant, or any other person who is aggrieved by any action of the planning commission, may appeal the matter to the board of supervisors by filing a written protest with the clerk of the board of supervisors within ten calendar days from the date of the action of the planning commission. The board of supervisors shall determine an appeal no later than the fourth regular meeting following the date on which the appeal was filed in its office. A permit may be reviewable by the State Mining and Geology Board pursuant to Public Resources Code § 2775. When such appeal is not available or is not taken, the action of the board of supervisors shall become final on the sixteenth day following its decision. (Ord. 2222 § 4, 1976; Ord. 1844 § 2 (part), 1971).

23.06.120 Violations. Violations of this chapter shall be punished as provided for in Title 1 of this code. (Ord. 1844 § 2 (part), 1971).

Harding Lawson Associates



February 12, 1988

17645,002.01

Mt. Burdell Enterprises
7 Fairway Drive
Mill Valley, California 94941
Attention: Mr. Anthony Georges

Gentlemen:

Estimated Reserves
Mt. Burdell Rock Quarry
Parcel No. 125-180-62
MRZ-2 Sector J
Petaluma Quadrangle, California

This letter presents our estimates of rock reserves within the Mt. Burdell Quarry area, Marin County, California. We understand that the quarry has been designated by the Marin County Planning Department as a Mineral Resource Zone Class 2 (MRZ-2) site containing deposits suitable as a marketable commodity, mainly asphaltic concrete aggregate or roadbase material. Based upon the California Division of Mines & Geology Special Report No. 146, it is estimated to contain 8 million tons of mixed non-pcc (Portland Cement Concrete) grade resource material. At your request we have reviewed the Special Report 146 and the Marin County Planning Department Report "Environmental Quality Element, Technical Report No. 2, Mineral Resource Preservation Sites in Marin County" as a draft document, dated May 1987. We have also reviewed the results of a geologic planning study we performed during 1986 and we have performed a brief reconnaissance of the quarry by our geologist to observe the various rock types visible in the quarry slopes.

From our review of Special Report 146 we understand that the reserve computation is based upon seismic measurements performed in 1955 shortly following opening of the quarry which indicated that the andesitic volcanic rock was 200 feet thick. The lateral dimensions of the deposit were based upon an estimate of the area of disturbed ground in the quarry area appearing on 1980 aerial photographs. Other factors used were a conversion factor of 11.9 cubic feet of rock per ton based upon density tests of samples from the quarry. 2:1 (horizontal to vertical) side slopes of the quarry were also used in the

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Mr. Anthony Georges
Mt. Burdell Enterprises
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calculation. No allowance was made for overburden or waste; the entire volume of rock was assumed suitable for asphaltic concrete aggregate or roadbase material.

Classification as MRZ-2 requires that the deposit meet a threshold value of \$5 million in 1978 dollars. An average value of \$2 per ton was used to compute the value. It is also stipulated that the aggregate material must have an overburden to ore ratio of less than 1:1 in order to be economical.

The attached geologic map is a portion of the Burdell Mountain property we previously mapped, encompassing the quarry area. As indicated by the contours, quarry slopes ranging up to about 150 feet in vertical height lie close to the southwest property boundary. Volcanic rocks are exposed in the quarry area (map symbol Tv) and are underlain by sedimentary rocks of the Great Valley Sequence (map symbol JKu) in the eastern quarry floor area. The volcanics terminate on the west against a fault and on the north where they lie in unconformable contact with the underlying Great Valley Sequence. Based upon our interpretation of the geology, including the relatively flat dipping basal contact of the volcanics, we estimate that the volcanics in the extreme western limits of the quarry do not penetrate to any appreciable depth below the existing quarry floor. The lateral constraints on the extent of volcanic rocks are indicated approximately on Plate 1. A further constraint on the rock that could be recovered in a quarrying operation are the 2:1 side slopes of the quarry excavation as stipulated in Special Report 146. Based upon these limits of recoverable volcanic rock in the quarry area, we estimate a maximum of approximately one million tons of volcanic rock above the existing quarry floor, or about Elevation 400 feet, and a maximum of 800,000 tons below the quarry floor to a depth of approximately 50 feet.

With regard to the waste rock to ore ratio, we have plotted the approximate areas of relatively hard flow rock visible in the quarry slopes and these shaded areas are noted on Plate 1. A possible extension between these two areas below the quarry floor is also indicated by cross-hatching on Plate 1. The remaining volcanic rock exposures in the quarry area consist of relatively friable, porous volcanic breccia and agglomerate which appear unsuitable for use as either asphalt concrete aggregate or roadbase material. We discussed this question with Mr. Dick Downs who was an employee of the quarry operator and was directly familiar with the operational problems. He

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Harding Lawson Associates

stated that during the latter phases of quarry operation, there was considerable difficulty in finding rock that met State specifications. At one point it was necessary to strip up to 35,000 cubic yards of overburden in order to recover 10,000 cubic yards of suitable material. Basically, the quarry shut down due to inability to economically recover aggregate materials that would meet State specifications. Ignoring the question of quarry reopening, we have estimated the probable remaining volume of recoverable hard flow rock that may be of suitable quality for the production of asphaltic concrete aggregate or roadbase material.

Using the factors provided in Special Report 146, we estimate that the volume of possible suitable rock remaining in the quarry is approximately as follows:

Proven and inferred	140,000 tons
Potential	260,000 tons
Total	400,000 tons

Any additional volumes would probably require overburden stripping ratios in excess of 1:1. On this basis, it is evident that the Mt. Burdell Quarry contains far less than the \$5 million threshold value for MRZ-2 classification. Even the entire recoverable volume of volcanic rock, if it were suitable, would at \$2 per ton, have a value substantially below the threshold value (\$3.6 million).

In summary, it is our opinion that the Mt. Burdell quarry should not be classified as MRZ-2. Very probably the remaining rock that might meet State specifications for asphalt concrete aggregate or roadbase material, is too small to warrant reopening of the quarry.

Yours very truly,

HARDING LAWSON ASSOCIATES

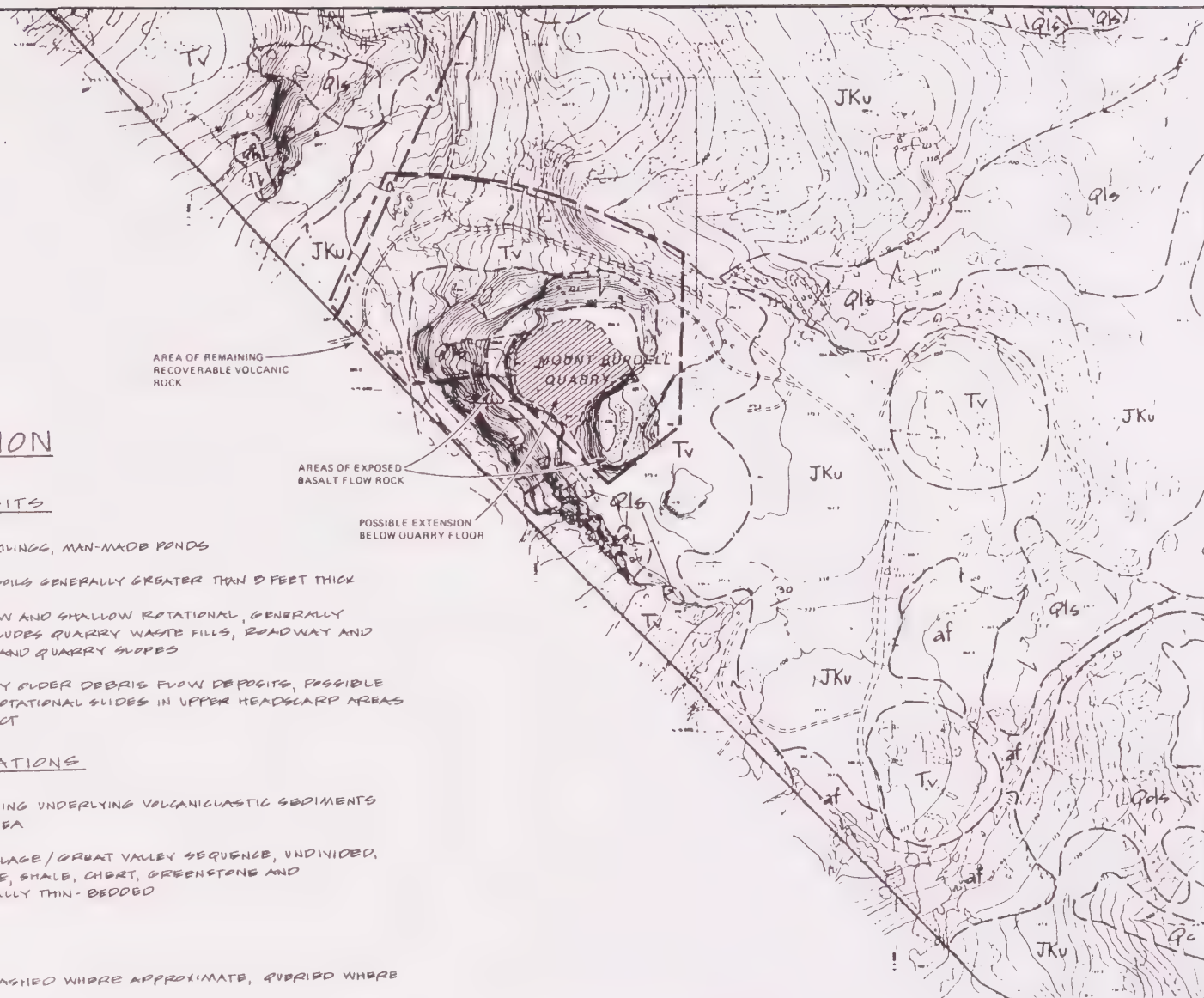


E.C. Winterhalder
Engineering Geologist - 272

ECW/mr

Attachment: Plate 1

2 copies submitted



EXPLANATION

GEOLOGIC AGE

SURFICIAL DEPOSITS

RECENT

af

ARTIFICIAL FILL; MINE TAILINGS, MAN-MADE PONDS

Qc

COLLUVIUM, COLLUVIAL SOILS GENERALLY GREATER THAN 2 FEET THICK

QUATERNARY

Qls

LANDSLIDE; EARTH FLOW AND SHALLOW ROTATIONAL, GENERALLY YOUNGER; LOCALLY INCLUDES QUARRY WASTE FILLS, ROADWAY AND POND EMBANKMENTS AND QUARRY SLOPES

Qols

LANDSLIDE; PRINCIPALLY OLDER DEBRIS FLOW DEPOSITS, POSSIBLE LOCALIZED DEEPER ROTATIONAL SLIDES IN UPPER HEADSCARP AREAS NEAR TV/JKu CONTACT

BEDROCK FORMATIONS

MIOCENE

Tv

VOLCANIC ROCKS INCLUDING UNDERLYING VOLCANICLASTIC SEDIMENTS IN THE NORTHEAST AREA

JURASSIC - CRETACEOUS

JKu

FRANCISCAN ASSEMBLAGE / GREAT VALLEY SEQUENCE, UNDIVIDED, INCLUDES GRAYWACKE, SHALE, CHERT, GREENSTONE AND SERPENTINITE; LOCALLY THIN-BEDDED

GEOLOGIC CONTACT, DASHED WHERE APPROXIMATE, QUESTIONED WHERE UNCERTAIN

FAULT, DASHED WHERE APPROXIMATE, QUESTIONED WHERE UNCERTAIN, DOTTED WHERE CONCEALED

APPENDIX 3. BIBLIOGRAPHY AND PERSONS CONSULTED

1. PART III of Special Report 146, Classification of Aggregate Resource Areas in the North San Francisco Bay Production-Consumption Region. California Department of Conservation, Division of Mines and Geology, 1983.
2. Deborah Herrman, Division of Mines and Geology.
3. Nancy Steiner, Division of Mines and Geology.
4. Dave Beeby, State Geologists Office.

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